Tactile Cueing as a Gravitational Substitute for Spatial Navigation During Parabolic Flight

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INTRODUCTION. Spatial navigation requires an accurate awareness of orientation in your environment. The purpose of this experiment was to examine how spatial awareness was impaired with changing gravitational cues during parabolic flight, and the extent to which vibrotactile feedback of orientation could be used to help improve performance. METHODS. Six subjects were restrained in a chair tilted relative to the plane floor, and placed at random positions during the start of the microgravity phase. Subjects reported their orientation using verbal reports, and used a hand-held controller to point to a desired target location presented using a virtual reality video mask. This task was repeated with and without constant tactile cueing of "down" direction using a belt of 8 tactors placed around the mid-torso. Control measures were obtained during ground testing using both upright and tilted conditions. RESULTS. Perceptual estimates of orientation and pointing accuracy were impaired during microgravity or during rotation about an upright axis in 1g. The amount of error was proportional to the amount of chair displacement. Perceptual errors were reduced during movement about a tilted axis on earth. CONCLUSIONS. Reduced perceptual errors during tilts in 1g indicate the importance of otolith and somatosensory cues for maintaining spatial awareness. Tactile cueing may improve navigation in operational environments or clinical populations, providing a non-visual non-auditory feedback of orientation or desired direction heading. Support was provided by NSBRI through NASA NCC 9-58 (NA0405).

Abstract to be submitted to: Eighth Symposium on the Role of the Vestibular Organs in Space Exploration, Houston, TX, April 8–10, 2011.